THE MAGAZINE OF METAL COMPONENT DESIGN AND PRODUCTION

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Precision Metal

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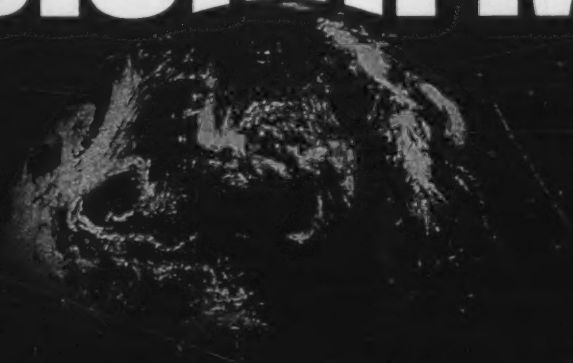

The Advancement of A Global Economy

STATE OF THE INDUSTRY REPORT

November 1987
Volume 45 No. 11

Precision Metal

THE MAGAZINE OF METAL COMPONENT DESIGN AND PRODUCTION

FEATURES

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The state of the precision metalworking industries is detailed in this comprehensive report which describes 1987 activity and provides insights into 1988. The *Industry Updates* review the condition of seven metal industries, including statistics on end use markets, production shipments and capital equipment buying activity. The *Raw Material Outlook* presents a brief appraisal of current conditions and forecasts for major industrial metals through the end of the decade.

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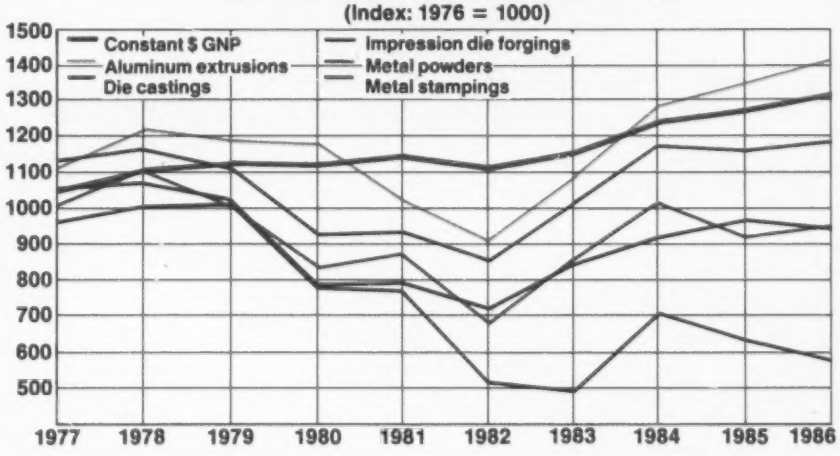
STATE OF THE INDUSTRY REPORT

A Staff Report

"...It's clear from the results of the past five years that almost every industry participates in a global market, and certainly, almost every industry is affected by actions in markets outside of the United States," observes Henry Johansson, chairman of Coopers & Lybrand Manufacturing Group Consultants.

In an effort to get a better idea of America's manufacturing future within this global economy, his consulting firm conducted a survey earlier this year of several hundred senior manufacturing executives and others involved in designing and manufacturing for Fortune 500 industrials. The results are quite telling.



Establishing a competitive position in the international marketplace is viewed as a very serious problem, and is ranked first among concerns of manufacturing personnel. Yet most manufacturers still believe the main competition is "coming from across the street rather than across the ocean", resulting in a minimal formulation of sufficient competitive strategies on a worldwide level.

For example, the survey reports U.S. manufacturers are not implementing high-level manufacturing technologies such as JIT and CIM (and to a lesser degree CAD, CAM & robotics) even though the need for such systems is understood and the advantages proven. The large financial investment required, the lack of senior management understanding and commitment, and the lack of skilled personnel are all seen as roadblocks. In fact, the recruiting, training and retraining of experts to manage these integrated technologies is seen as a problem serious enough to severely inhibit the pace of technology integration in the U.S.

What can be done to survive and prosper in a global economy in the face of such obstacles? According to the survey, manufacturing executives are highly opposed to federal protectionist legislation, while only a small portion consider import restrictions to be very effective government policy. Instead, they wish to see relaxation of antitrust laws and the restoration of the investment tax credit eliminated in 1986 tax reform.

The survey suggests manufacturing management must take steps to prevent an exodus of technically knowledgeable workers by developing more clearly defined career paths within an organization. Educating and developing additional staff to increase the rate of technology integration is also a must.

There is a need now for new systems of allocating funds for a technological environment, and cost justification of advanced manufacturing systems. These are the investments to ensure long term success.

PRECISION METAL's own research tends to reflect these findings. Whether a small metalforming shop or the country's largest precision foundry, manufacturers are confident in their futures and in the knowledge of what must be done to survive. Downturns in the economy and consequently in this industry (as shown all too well in the adjoining chart) have destroyed some and hurt most. But the survivors agree. The face of metalworking has changed forever and those who adapt will prosper. *The Editors*

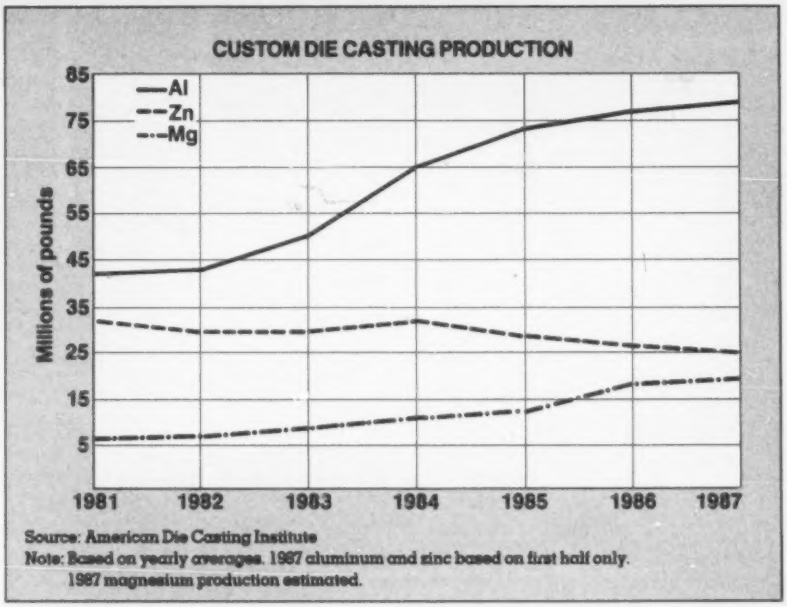
Industry updates

Die casting

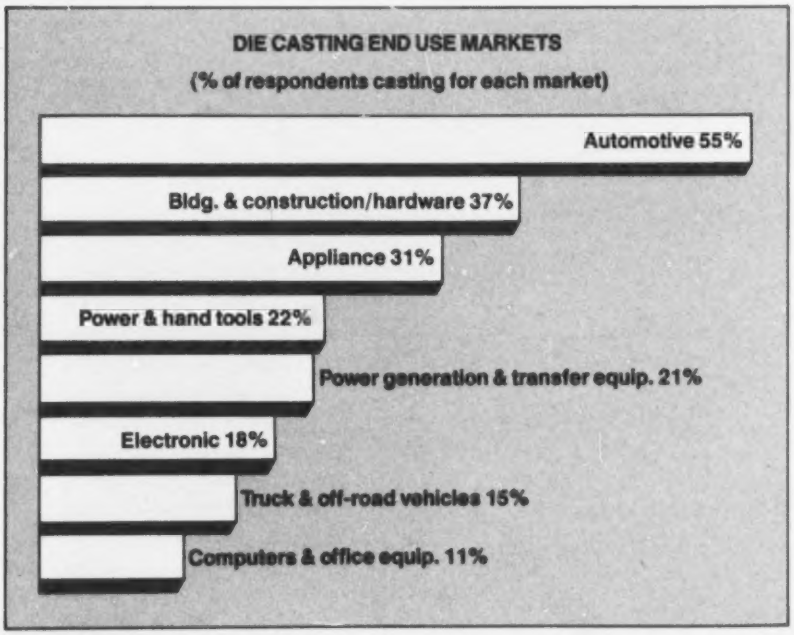
With the era of the "fat 1960's and 1970's" long gone and the economic upheaval of the early 1980's settled, a leaner, more productive die casting industry has emerged. Total die casting industry sales are again on the rise with 1987 estimates by the American Die Casting Institute (ADCI) set at $6.4 billion, an increase of 6% over 1986. The industry upturn will most likely continue through 1988 with an additional 6% increase in sales over 1987 projected at $6.8 billion. However, with a substantial portion of this increase reflecting a rise in aluminum and zinc alloy prices, actual profits will continue to be "squeezed in the middle," says the ADCI.

In terms of tonnage, 1987 aluminum custom and captive production is estimated to be up by 5%, and sales up 7% over 1986. Total zinc production is also estimated to rise 5% in 1987, with sales up by 8%.

Magnesium continues to show its future potential, with an expected increase in 1937 tonnage of 15% compared to 1986. "With magnesium the most active part of our operation now," relates an optimistic die caster, "we are adding 30% to our magnesium capabilities for next year."



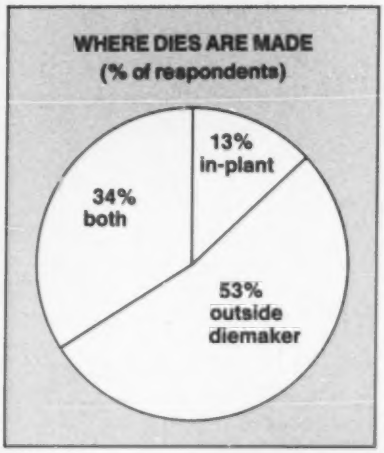
Source: American Die Casting Institute
Note: Based on yearly averages. 1987 aluminum and zinc based on first half only. 1987 magnesium production estimated.

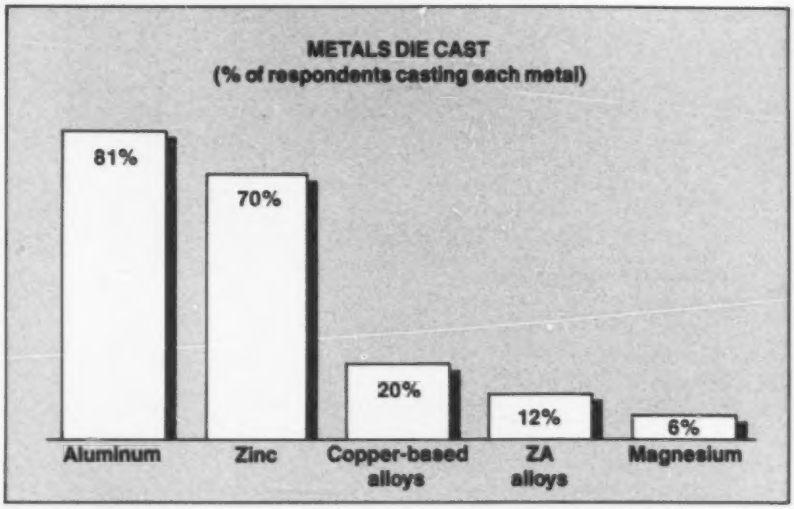

DIE CASTING END USE MARKETS
(% of respondents casting for each market)
Automotive 55%
Bldg. & construction/hardware 37%
Appliance 31%
Power & hand tools 22%
Power generation & transfer equip. 21%
Electronic 18%
Truck & off-road vehicles 15%
Computers & office equip. 11%

An important key to a better future coupled with higher profitability, is the increased use of technology. Several die casters who are experiencing capacity production attribute this to implementation of strict quality and process control measures. "Although expensive to implement, once working effectively, statistical process control can save the producer and the end user money. It means fewer inspections and rejects," notes a spokesman for a large Midwestern die casting operation. He claims that his company is running at the best new die sales in its history. "All customers -old and new- are demanding quality control measures now," he added.

Executives at Visi-Trak Corp., Cleveland, OH, a supplier of advanced process control and computer monitoring systems to the die casting industry, believe inter-

est in these systems is extremely high, but add that actual use and commitment is in its infancy. "Many die casters are making moves in this area strictly because their customers demand it," says a spokesman for Visi-Trak, "not because they perceive the need themselves." He added that this attitude is starting to change, with the more progressive die casters realizing that advanced technology can "really do something for their operation."





Education and aggressive marketing are also continually being used to answer die casting's competition domestically and abroad. Interest in the relatively new Diecasting Development Council is exceeding expectations. The Council will continue to solicit and allocate more dollars to help edu-

COMPONENT MANUFACTURER DIE CASTING FURNACES (breakdown & holding)

	Number of furnaces	Amount 10-20 yrs. old	Amount over 20 yrs. old	To be replaced in 1988	To be rebuilt in 1988	To be added to capacity in 1988
Fuel-fired	615	309	53	42	113	38
Electric	205	47	2	5	23	9

Cost of nonferrous castings[1] purchased (millions of $ delivered cost)[2]

End use markets	1977	1982	1988
Communication equipment			
Telephone/telegraph (aluminum & alloy)	9.2	6.6	12.5
Radio/TV communication equipment (aluminum & alloy)	51.4	74.8	141.1
Electronic computing equipment (aluminum & alloy)	39.5	104.4	147.5
(other nonferrous)	—	8.6	12.2
Household appliances			
Cooking equipment (aluminum & alloy)	6.6	41.7	56.4
Laundry equipment (aluminum & alloy)	17.6	17.7	27.2
(zinc & alloy)	7.4	4.8	7.4
Electric housewares (aluminum & alloy)	29.0	14.2	13.4
(zinc & alloy)	5.6	24.4	23.0
Lawn & garden equipment			
(aluminum & alloy)	20.1	33.5	53.0
(other nonferrous)	—	5.6	8.9
Motor vehicle parts & accessories			
(aluminum & alloy)	536.1	691.3	1237.6
(zinc & alloy)	—	22.7	40.6
Power driven hand tools (aluminum & alloy)	36.5	39.9	51.5
(other nonferrous)	—	9.5	12.3

[1] Rough & semifinished
[2] Rated at value or projected value of the dollar for each year listed
Sources: U.S. Department of Commerce & Fenton Marketing Information estimates

COMPONENT MANUFACTURER DIE CASTING MACHINES

Hot chamber machines (Size in tons of locking force)	Number of machines	Amount 10-20 yrs. old	Amount over 20 yrs. old	To be replaced in 1988	To be rebuilt in 1988	To be added to capacity in 1988
Under 100	105	78	11	4	16	4
101-250	54	28	19	1	8	1
251-400	58	27	29	—	10	2
401-550	38	26	11	2	7	5
551-700	18	6	6	1	—	—
701-850	11	7	1	—	2	—
851-1000	3	2	—	—	—	2
1001-2000	2	2	—	1	—	—
Over 2000	—	—	—	—	—	—
Cold chamber machines						
Under 100	5	—	—	—	—	—
101-250	26	8	9	—	—	—
251-400	60	25	11	6	5	4
401-550	74	39	22	6	9	—
551-700	141	76	16	3	14	—
701-850	66	41	8	2	8	1
851-1000	34	23	2	1	4	2
1001-2000	43	23	9	1	4	2
Over 2000	2	—	—	—	—	2

State of the Industry Report

A note about survey data...

Annually, PRECISION METAL surveys a sizable portion of die casting industry corporate officers to get an idea of what changes have occurred, and what are likely to occur in the industry during the coming year.

Results of our report include data for 16.25% of 400 custom and captive die casting plants surveyed in the United States and Canada.

73.5% of our respondents were custom part producers, 7.7% were exclusively captive operations, while the remainder performed custom and captive work.

The highlight of our report is the die casting machine survey, since capital equipment buying decisions can be an excellent measure of current and expected business activity.

cate the user of die castings. Programs organized by raw material suppliers are also teaching the designer the "unlimited possibilities" of die cast components and technology.

"The picture for the future essentially remains unchanged," states Peter Findlay, president of the ADCI. "The need remains to develop new markets, or get old ones back, and increase the use of technology to improve productivity and therefore profitability!"

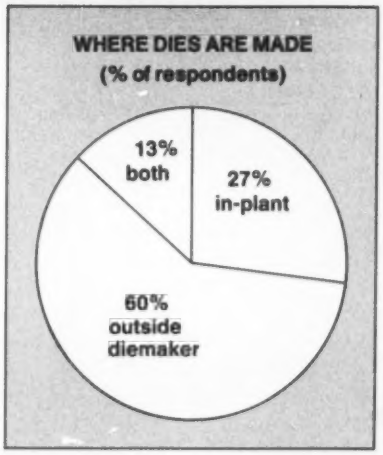
Extrusion

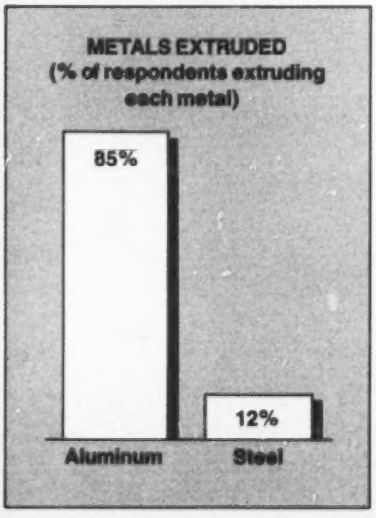
Key indicator figures of the latest Aluminum Extruders Council (AEC) survey show total shipments of aluminum extrusions up 23% for the second consecutive quarter of 1987 over 1986. Companies with extrusion press capacities up to 2250 tons showed increases over first quarter 1987 production figures, while firms with press sizes exceeding 2251 tons reported a decrease of 1.1%.

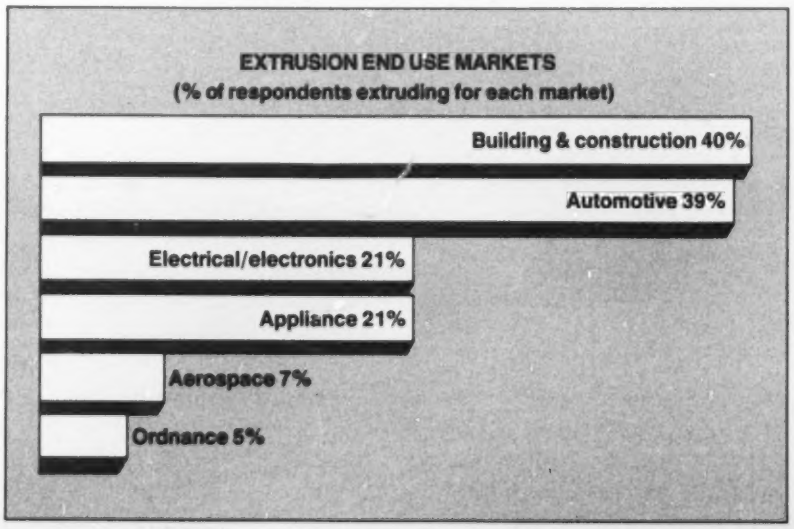
Overall, extruders feel the momentum of upward sales will continue in spite of concern over the unstable price of aluminum.

Vinyl has continued to make substantial gains in aluminum extruders' markets, while many customers continue to question their confidence in extrusion due to this aluminum price fluctuation. This in turn is limiting capital equipment expenditures by the extruder, for the most part, forcing them to adopt a "wait-n-see" attitude before making further investments.

In an effort to boost industry confidence, and get customers back into the fold who may have strayed to competing materials such as vinyl, the AEC launched its *Shapemakers* program in September. Borrowed heavily from the successful British program by the same name, *Shapemakers'* goal will be to actively stimulate devel-







State of the Industry Report

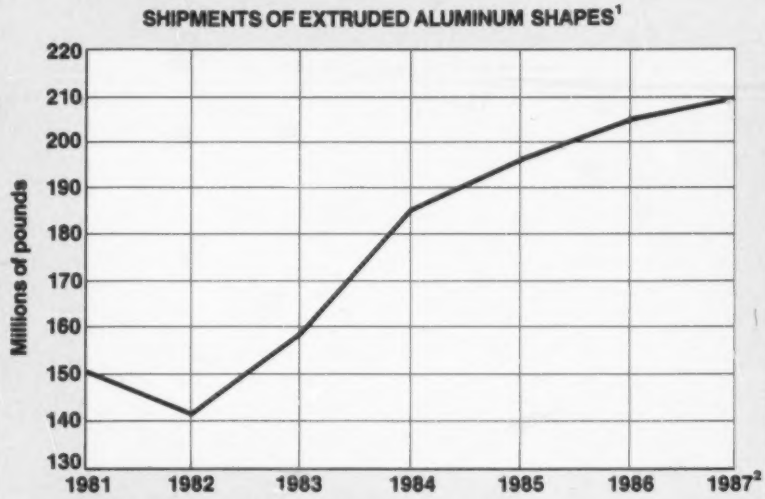
A note about survey data...

Annually, PRECISION METAL surveys a sizable portion of extrusion industry corporate officers to get an idea of what changes have occurred, and what are likely to occur in the industry during the coming year.

Results of our report include data for 14% of the 200 custom and captive extruders surveyed in the United States and Canada.

71% of our respondents were custom part producers, 4% were exclusively captive operations, while the remainder performed custom and captive work.

The highlight of our report is the extrusion press survey, since capital equipment buying decisions can be an excellent measure of current and expected business activity.



Source: U.S. Dept. of Commerce, Bureau of the Census
[1]Domestic receipts only
[2]Based on first seven months of 1987

Overall, extruders feel the momentum of upward sales will continue in spite of concern over the unstable price of aluminum.

Cost of extruded aluminum shapes[1] consumed (millions of $ delivered cost)[2]

End use markets	1977	1982	1988
Aerospace equipment & parts			
Aircraft	63.2	83.4	116.8
Aircraft engines & engine parts	8.1	31.4	42.4
Other aircraft equipment	29.8	87.5	196.7
Communications equipment			
Radio/TV sets	3.1	—	4.3
Telephone/telegraph	3.6	5.7	10.8
Radio/TV communication equipment	17.5	20.0	37.7
Electronic computing equipment	4.7	20.0	28.3
Fabricated structural metal products			
Metal doors, sash & trim	340.0	568.7	575.0
Architectural metal work	29.1	54.6	55.2
Prefabricated metal buildings	10.3	32.6	38.5
Household appliances			
Cooking equipment	7.6	10.6	14.3
Refrigerators & freezers	—	12.2	17.1
Electric housewares & fans	4.2	6.8	6.4
Motor vehicles & equipment			
Motor vehicle & car bodies	—	23.1	36.0
Truck & bus bodies	18.0	25.1	45.5
Vehicle parts & accessories	37.7	18.9	33.8

[1] Includes rod, bar, pipe & tube
[2] Rated at value or projected value of the dollar for each year listed
Sources: U.S. Department of Commerce & Penton Marketing Information Center estimates

opment of new aluminum extrusion applications while defending and enhancing present uses. This will be achieved by increasing awareness of aluminum extrusions and its benefits especially over competing materials and processes, stressing the advantages of aluminum properties, and providing product information to present and potential users. This will be achieved through a carefully implemented program, targeted to the end user, to increase in prominance and effectiveness into the 1990's. Specific plans include a new brochure on extrusion basics, trade magazine advertising, a newsletter outlining new and different extrusion applications, fact files targeted to specific topics and end use markets, an annual industry guide of extruders including press capacities and capabilities, and finally, feature articles on extrusion to be supplied to trade and consumer magazines.

"It is only during the last four years or so that the volatility of alu-

minum pricing has caused some people to look elsewhere for their shapes," says George Levy, president of National Aluminum Extrusion Div., and chairman of the AEC. But he stresses this is just a temporary blow to the industry, soon to be softened by the *Shapemakers* program —a program that in conjunction with aggressive individual sales and marketing, will help, says Levy, "stir our sleeping giant" known as the aluminum extrusion industry.

COMPONENT MANUFACTURER EXTRUSION PRESSES

Presses (Size rating in tons)	Number of presses	Amount 10-20 yrs. old	Amount over 20 yrs. old	To be replaced in 1988	To be rebuilt in 1988	To be added to capacity in 1988
Under 1000	273	32	156	2	53	10
1001-3000	191	20	164	1	105	8
3001-5000	59	5	51	1	50	2
5001-7000	5	3	—	—	2	—
Over 7000	10	—	2	5	—	—

Forging

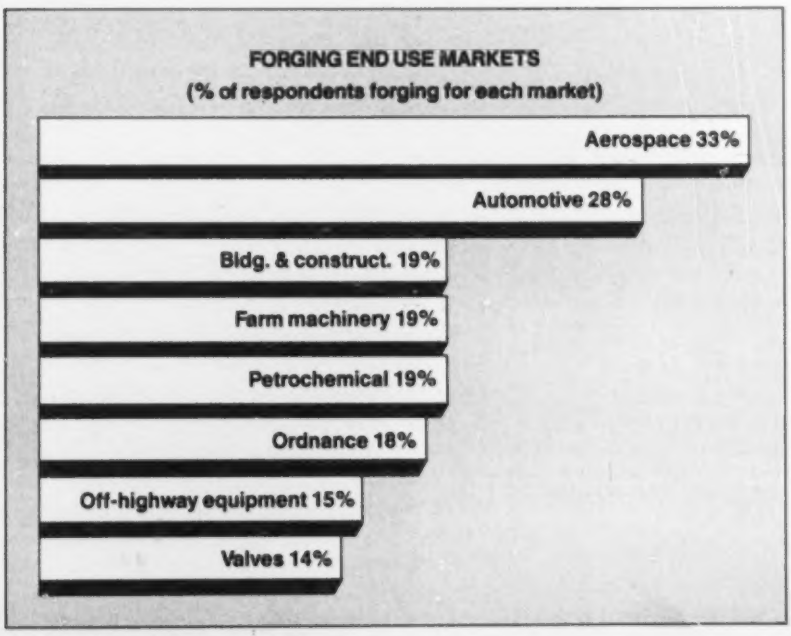
The forging industry last year had to grapple with several seemingly incompatible facts. Despite a weaker dollar and lower raw material costs, foreign producers increased their share of the U.S. and Canadian market for ferrous forgings from 32% in 1985 to 36% in 1986. Also, conservative estimates are that imports accounted for another 13% of the ferrous forgings market through the value of machined steel forgings contained in end use products. This means that offshore sources accounted for virtually half (49%) of the total apparent consumption of ferrous forged products — an increase from 39% in 1984.

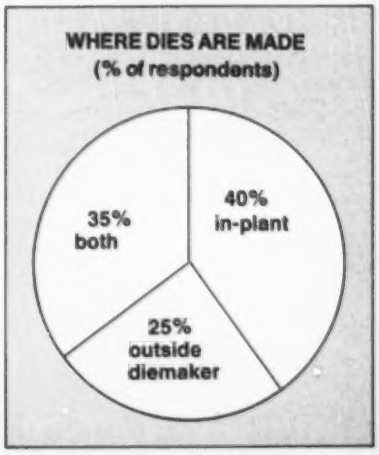
While many forgers believe the declining dollar may provide some respite from spiraling imports, it has had little effect yet because of existing long-term contracts and offshore producers' resolve to maintain their share of North American markets — even if it means absorbing losses.

"Our gut feeling is that it certainly has helped. But how much it has helped remains to be seen because those things do have a lag relationship," states Robert At-

FORGING METHODS

Types performed	% of respondents
Closed die	49
Open die	38
Upsetting	31
Ring rolling	13
Cold & hot extrusion	4





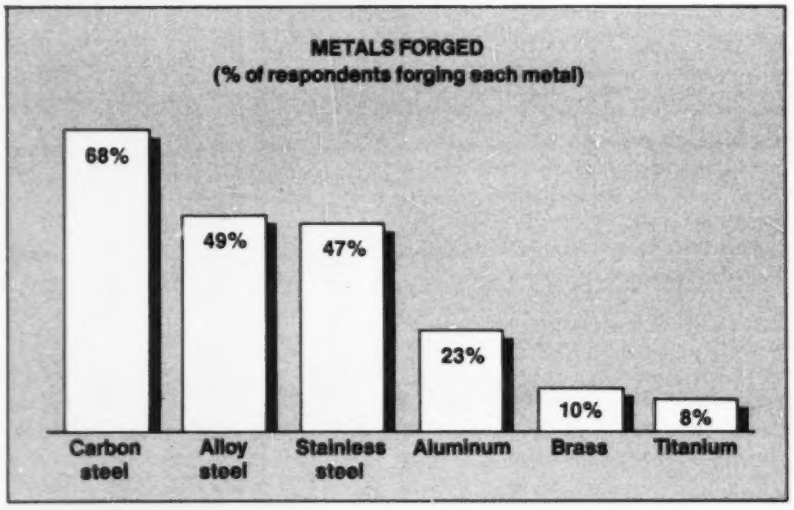
kinson, executive vice president of the Forging Industry Association (FIA).

Just a year ago the U.S. International Trade Commission reported that foreign steel prices ranged from 20-36% below domestic prices in 1985. That advantage no longer exists because in 1986 U.S. domestic steel prices became very competitive with offshore prices. Hopefully, this will provide a future basis for regaining forging business lost to foreign sources.

"When some of these buyers discover that they're having delivery and service problems, they might start sourcing in the U.S. again," remarks a spokesman at a large Midwestern forging plant. "We don't anticipate import penetration figures to go down, but we don't expect them to rise sharply, either."

Industry experts agree that today's successful forger is not sitting back and waiting for things to change. He has adapted and adjusted to the more competitive market of the past five years, and he has consolidated and re-structured to meet the requirements of a shrinking industry.

According to one industry spokesman, the future for many



Cost of forgings purchased (millions of $ delivered cost)[1]

End use markets	1977	1982	1988
Aerospace equipment & parts			
Aircraft (iron & steel)	27.9	15.5	21.7
(aluminum & alloy)	45.5	63.6	89.0
(titanium & alloy)	37.0	—	97.9
Aircraft engines and engine parts			
(iron & steel)	106.1	510.1	689.4
(aluminum & alloy)	4.6	15.1	20.4
(titanium & alloy)	62.6	345.3	466.7
Other aircraft equipment			
(iron & steel)	31.9	87.6	196.9
(aluminum & alloy)	30.8	63.1	141.8
(titanium & alloy)	—	8.3	18.7
Guided missiles & space vehicles			
(iron & steel)	0.8	—	4.0
(aluminum & alloy)	1.8	3.3	6.6
Other space vehicle equipment			
(iron & steel)	1.4	2.2	5.5
(aluminum & alloy)	1.4	2.0	5.0
(titanium & alloy)	—	2.2	5.5
Farm machinery & equipment (iron & steel)	96.9	89.9	82.1
Motor vehicles and equipment			
Motor vehicle parts & accessories			
(iron & steel)	997.3	1048.7	1877.4
(aluminum & alloy)	46.2	15.9	28.4

[1] Rated at value or projected value of the dollar for each year listed
Sources: U.S. Department of Commerce and Penton Marketing Information Center estimates

COMPONENT MANUFACTURER FORGING HAMMERS

Hammers (by lb. mass of ram)	Number of hammers	Amount 10-20 yrs. old	Amount over 20 yrs. old	To be replaced in 1988	To be rebuilt in 1988	To be added to capacity in 1988
Less than 1000	37	6	31	—	3	—
1001-5000	306	71	192	1	30	4
5001-10,000	50	13	31	—	4	—
10,001-25,000	18	1	16	1	3	—
Over 25,000	9	3	6	—	3	1

COMPONENT MANUFACTURER FORGING MACHINES

Mechanical forging machines	Number of machines	Amount 10-20 yrs. old	Amount over 20 yrs. old	To be replaced in 1988	To be rebuilt in 1988	To be added to capacity in 1988
½	9	5	3	—	2	1
1	2	—	2	—	—	1
1½	11	3	7	—	—	—
2	10	2	8	—	—	1
2½	8	1	5	—	—	1
3-4	29	6	21	—	5	1
5-6	43	10	26	—	7	2

COMPONENT MANUFACTURER FORGING PRESSES

Mechanical Presses (by tons force rating)	Number of presses	Amount 10-20 yrs. old	Amount over 20 yrs. old	To be replaced in 1988	To be rebuilt in 1988	To be added to capacity in 1988
100-500	81	17	53	—	2	1
501-1000	73	16	46	1	5	3
1001-2000	50	20	24	—	3	6
2001-5000	22	11	6	—	4	4
Hydraulic Presses						
100-500	41	16	23	—	3	—
501-1000	30	14	15	1	5	3
1001-2000	23	11	6	—	2	2
2001-5000	8	5	3	—	—	2
5001-10,000	4	—	3	—	1	—

small to mid-size forging plants is in finding a niche, and running a smaller, more specialized operation. "Finding a niche is probably the only alternative they have, but I think it's going to take some marketing to look at end uses," he adds. "Some forging companies sit and wait for the phone to ring, or keep serving repeat business to a standard customer base. But they have to expand their base, because if that customer changes sources, they're out of business. What's needed is a combination of cost cutting, marketing, and finding a niche."

"Forgers are also providing support and training to utilize quick change tooling and automation," states George Pirics, district manager of National Machinery Co. "But the biggest thing is that the forger is managing his business better, demanding greater efficiency, reduced costs and better parts, and is passing all this along to his customer."

A note about survey data...

Annually, PRECISION METAL surveys a sizable portion of forging industry corporate officers to get an idea of what changes have occurred, and what are likely to occur in the industry during the coming year.

Results of our report include data for 23% of the 338 custom and captive forging plants surveyed in the United States and Canada.

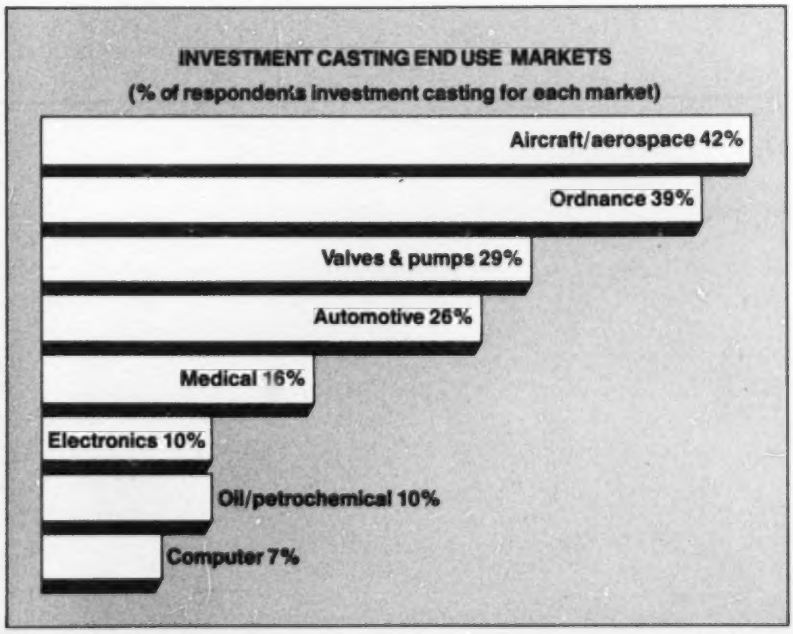
72% of our respondents were custom part producers, 10% were exclusively captive operations, while the remainder performed custom and captive work.

The highlight of our report is the forging press survey, since capital equipment buying decisions can be an excellent measure of current and expected business activity.

Investment casting

Overall, the outlook for the investment casting industry is encouraging with expectations that 1987 sales will finish about 10 to 15% ahead of 1986. And many investment casters expect 1988 to be strong, too.

Gorham Advanced Materials Institute, Gorham, ME, reports that annual growth rate estimates for the United States and Canada range from 7 to 12% annually for the next 10 years with some specialty areas forecast to grow at rates as high as 30%. By 1996, a Gorham study states, investment cast shape components for high performance uses in markets such as aerospace, avionics, aircraft, biomedical, office equipment, automotive and machine tools, among others, will account for a significant share of a potential $5 to $10 billion market.



Aerospace applications continue to be the strongest end use for investment castings, according to R. Russell Stratton, executive director of the Investment Casting Institute (ICI). "The aerospace sector has enjoyed 18 months of strong sales and will continue to for at least the next 24 months," he explains.

Commercial investment casting applications appear to have stabilized. This area, Stratton says, "was unsettled until the period from November 1986 to January 1987 at which time the markets started to firm, and optimism has been growing ever since."

The ICI expects profits in both the aerospace and commercial sectors to increase as well because capacity utilization continues to be above the 67% mark.

While investment casters have been somewhat cautious about the effect that imports have had on their industry, most indicate that the impact has not been as direct as it has been with other industries. Stratton explains, "Our industry demands close communications with customers and this tends to dictate a parochial relationship between investment

casters and their customers."

Other factors which have worked to keep investment casting customers from sourcing overseas include the weakening of the dollar on the world market, product quality problems, trends toward keeping low inventories and increasing emphasis on Just-In-Time scheduling. In fact some investment casters say they have seen cases of offshore business returning to this country.

The main area where imports pose a threat is extremely high volume items that permit long lead times. But for many products, certain volumes of business are not that forecastable.

Amidst complaints about imports from nearly all sectors of American industry, there are a few areas where domestically produced investment castings are being used in products bound for overseas markets. Components such as an impeller in a pump assembly, some elements of a complete hip joint prosthesis package, and certain parts within a military jet engine are among the castings being exported.

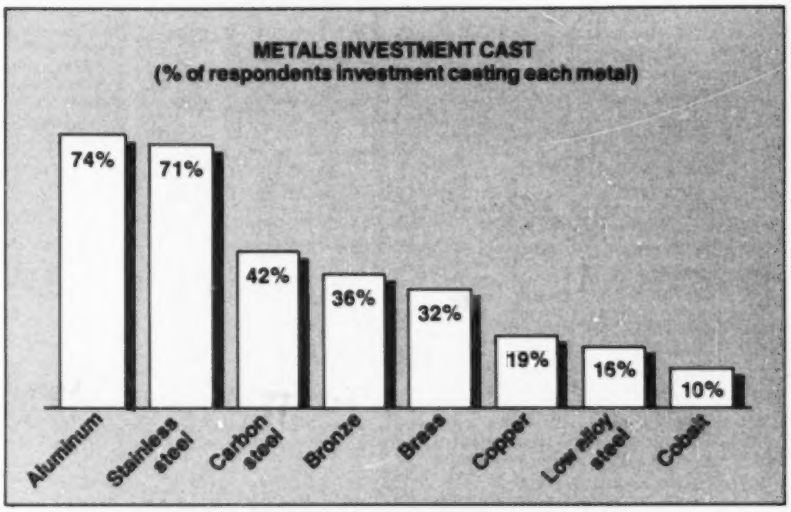
Technological breakthroughs are being utilized by investment casters to hone their traditional skills and improve process efficiency, thereby strengthening their competitive standing in the world marketplace.

New binders are said to make it possible to build shells in one to two days, with improved dimensional control and little or no first-coat cracking. Using conventional binders these shells might take a week or more to produce.

Automated pouring systems can improve safety and repeatability while reducing spillage by automatically positioning the ladle and controlling molten metal flow rates.

Metal purity, essential to casting integrity, is being improved through such methods as electron beam remelt, utilization of improved decarburization systems and inert atmosphere protection of molten metal.

By continuing its aggressive pursuit of technological advancements to enhance process efficiency and product quality, the investment casting industry is gaining credibility as commercially and strategically healthy i today's global economy.



COMPONENT MANUFACTURER INVESTMENT CASTING INJECTORS/EXTRUDERS

	Number of injectors, extruders	Amount 10-20 yrs. old	Amount over 20 yrs. old	To be replaced in 1988	To be rebuilt in 1988	To be added to capacity in 1988
Wax injectors	252	99	38	9	33	25
Wax extruders	20	4	—	—	—	4

By 1996 investment cast shape components for high performance uses will account for a significant share of a potential $5 to $10 billion market.

A note about survey data...

Annually, PRECISION METAL surveys a sizable portion of investment casting industry corporate officers to get an idea of what changes have occurred, and what are likely to occur in the industry in the coming year.

Results of our report include data for 14.1% of the 270 custom and captive investment casting foundries surveyed in the United States and Canada.

87.1% of our respondents were custom part producers, 3.2% were exclusively captive operations, while the remainder performed custom and captive work.

The highlight of our report is the investment casting wax injector/extruder survey, since capital equipment buying decisions can be an excellent measure of current and expected business activity.

Powder metallurgy

The powder metallurgy industry has prospered in the last couple of years, one of the healthiest sectors in the metalworking field. North American metal powder shipments in 1986 were up slightly to 273,000 tons, compared to 269,000 tons in 1985. Total shipments for 1987 are estimated at 283,000 tons, and by 1992 this could increase to 327,000 tons. For 1987, these shipments will have a value of between $460 and $505 million, and by 1992 this should increase to $597 to $600 million.

In 1986, production acceptance of the powder forged automobile engine connecting rod was one of the single most important boosts for the P/M industry. Referring to Ford Motor Company's use of P/M "con-rods" in the 1.9 liter engine for Escort and Lynx models, Kempton Roll, executive director of the Metal Powder Industries Federation (MPIF) states, "P/M forging has been given the go-ahead from a quality and safety-conscious industry. This is the ultimate test of acceptance."

Other critical P/M parts used in cars are roller bearing races, one-way transmission clutch races, and a torque converter hub. New P/M products being considered include sprockets and valve-seat inserts in aluminum cylinder head engines and valve-guide bushings. The average full-size passenger car now contains up to 20 lb of P/M parts.

Roll also reports that Ford is reviewing P/M "con-rods" for the modular engine planned for 1991 that could represent a potential consumption of 10 million conrods annually.

Although conventional press and sinter technology continues to be the mainstay of the P/M industry, development work is progressing in injection molding, rapid solidification technology, high-temperature sintering, hot isostatic pressing, and new materials like the nickel aluminides. "These processes are still in the early growth stages, but the outlook for development is excellent," reports Peter Johnson, marketing director of the MPIF.

One of the brightest spots in P/M is the impending growth and technical maturing of injection molding, a process that, according to Roll, "...is marrying the best features of ceramics, powder metallurgy, and plastics technology." Some experts predict that this sector of the industry could reach $400 million in annual sales within the next ten years, which is well above the current sales level of $10-15 million annually. There are approxi-

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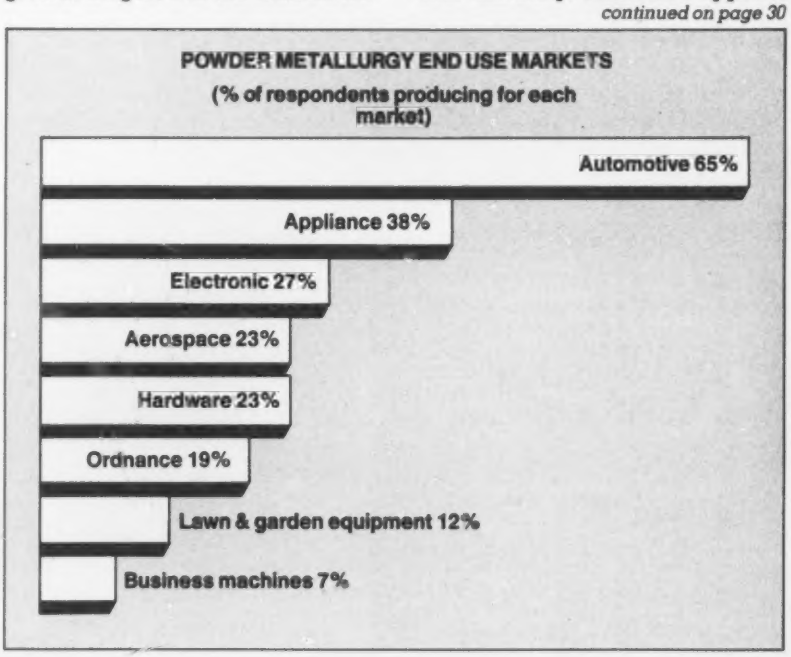


COMPONENT MANUFACTURER

POWDER METALLURGY SINTERING FURNACES

	Number of furnaces	Amount 10-20 yrs. old	Amount over 20 yrs. old	To be replaced in 1988	To be rebuilt in 1988	To be added to capacity in 1988
Electric	345	69	228	3	26	12
Fuel-fired	42	12	6	—	5	1

POWDER METALLURGY COMPACTING PRESSES

	Number of furnaces	Amount 10-20 yrs. old	Amount over 20 yrs. old	To be replaced in 1988	To be rebuilt in 1988	To be added to capacity in 1988
Mechanical	211	193	87	8	9	22
Hydraulic	63	31	7	—	3	12

Cost of metal powders consumed (millions of $ delivered cost)[1]

End use markets	1977	1982	1988
Farm machinery & equipment	3.5	0.6	0.6
Household appliances			
Laundry equipment	1.6	7.6	11.7
Electric housewares & fans	4.4	—	5.1
Lawn & garden equipment	7.3	9.8	15.5
Metalworking machinery & equipment			
Metal cutting machine tools	0.2	0.9	0.6
Special dies, tools, jigs & fixtures	9.8	18	25.9
Machine tool accessories	134.2	124	172.5
Motor vehicle parts & accessories	56.8	76.9	137.7

[1] Rated at value or projected value of the dollar for each year listed
Sources: U.S. Department of Commerce & Penton Marketing Information Center estimates

continued from page 26

mately 22 companies presently engaged in the commercial manufacture of metal injection molded products — shapes that could otherwise not be manufactured cost-effectively or would not exist at all, or might have ended up as a plastic product.

Although injection molding is being touted as "the wave of the future", it is important to keep in mind that it is a highly specialized process that will supplement and not replace existing press and sinter mass production. "Parts tend to be much smaller — on the order of fractions of an ounce — than conventional press and sinter iron and steel parts, and they offer superior properties over plastic parts made by much the same process," states one industry analyst. "However, the cost of the starting materials is relatively high." Despite the fact that this segment of the P/M industry employed fewer than 100 people in 1985, large growth rates are foreseen.

Those involved in the P/M industry are optimistic that the technology is making inroads against other methods of manufacturing metal components including machining processes. They cite cost savings, a wide range of properties, and the ability to provide a complex shape with minimum secondary operations, as just some of the reasons why the industry can look forward to a prosperous future.

P/M METHODS

Types performed	% of respondents
Metal injection molding	15
Isostatic CIP	12
Liquid phase-high density	8

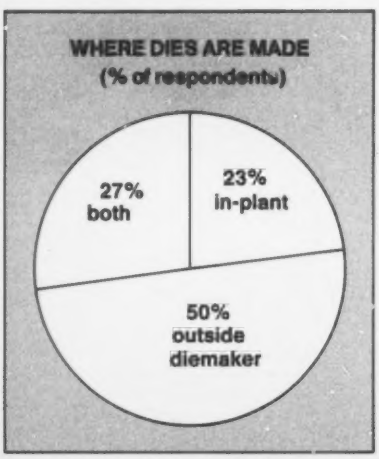
A note about survey data...

Annually, PRECISION METAL surveys a sizable portion of powder metal industry corporate officers to get an idea of what changes have occurred, and what are likely to occur in the industry during the coming year.

Results of our report include data for 15% of the 174 custom and captive P/M plants surveyed in the United States and Canada.

78% of our respondents were custom part producers, 10% were exclusively captive operations, while the remainder performed custom and captive work.

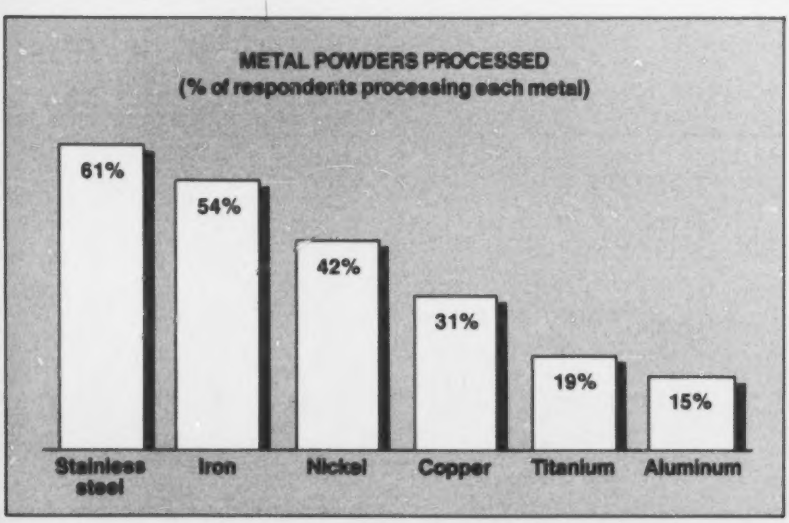
The highlight of our report is the P/M press survey, since capital equipment buying decisions can be an excellent measure of current and expected business activity.



Powder shipments for P/M parts (1000s of tons)

	1982	1983	1984	1985	1986	[1]1987
Iron powder	111	154	183	163	174	180
Copper and copper base powder	14	18	21	16	16	16

Source: Metal Powder Industries Federation [1]projected

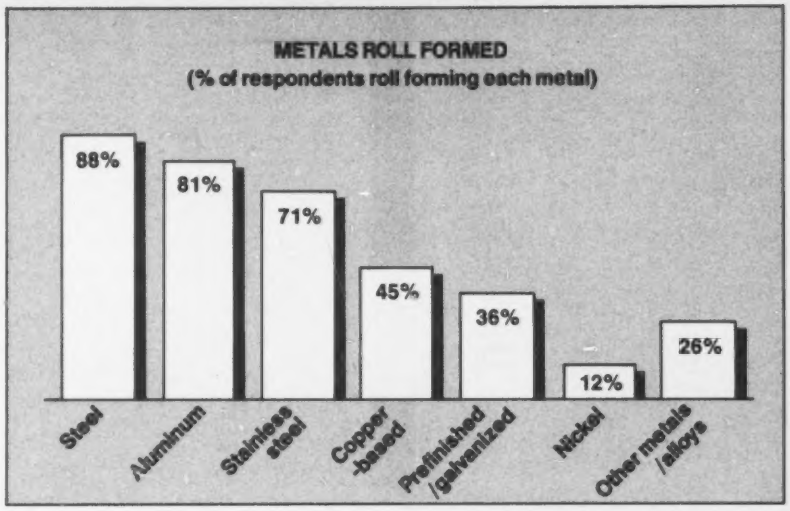


Roll forming

Availability and quality, coupled with increasing costs and long lead times, are the major problems that roll formers are facing with raw material these days — particularly with steel. It is a disturbing trend that seems to be escalating.

According to quarterly statistics compiled by the Custom Roll Forming Institute (CRFI) the percentage of roll formers who reported that steel supplies were tighter than in the preceding quarter rose from 52% in the first quarter of 1987, to 60% in the second and 80% in the third quarter. "The biggest problem for roll formers right now is this rapidly accelerating steel shortage which is becoming quite serious in this country," explains Robert Boeddener, president of the CRFI.

To compound the frustration many roll formers are feeling, more and more American companies are implementing Just-In-Time production systems. And the trend is starting to impact producers of roll formed shapes. The result is that users are demanding shorter lead times and ordering smaller quantities, expecting roll formers to carry their inventory.

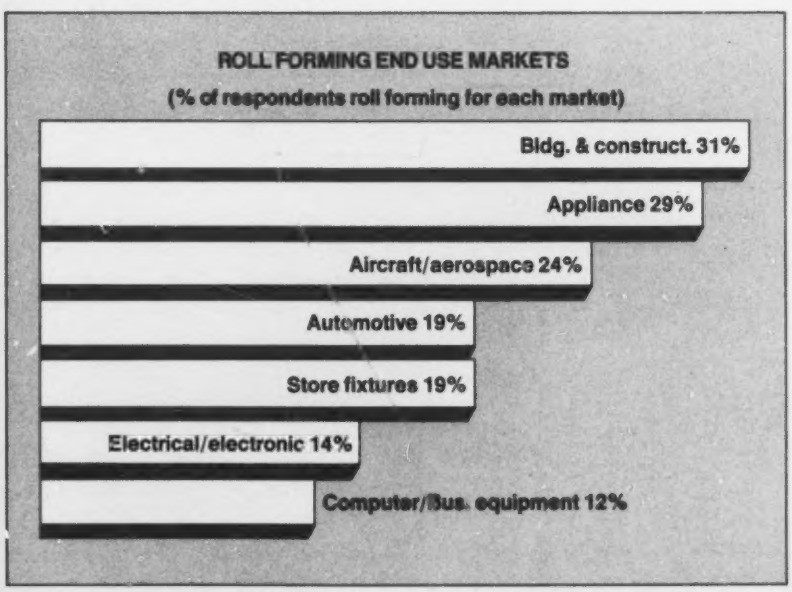


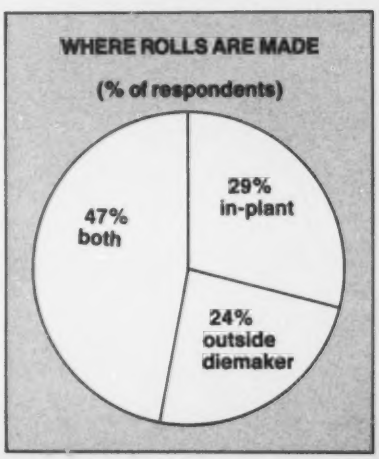
Finding and keeping qualified mill operators and set-up personnel has been the longest running problem roll formers have had to deal with. As one Midwestern roll former states, "We have been training mill operators for the automobile companies for 20 years."

"The biggest problem for roll formers right now is this rapidly accelerating steel shortage which is becoming quite serious in this country."

But the overall outlook for roll forming is encouraging. Over the past several years, the roll forming industry has experienced slow, but steady economic growth. 1987 seems to be continuing that trend, and more of the same is expected for 1988.

"Since the recession of the early 1980s, our industry has been experiencing a positive economy — one that is more likely to continue than if it had been 'boom' growth





— and that is encouraging," says Boeddener.

"There are a couple of CRFI members who are concerned because a big market of theirs seems to be drying up. But most roll formers feel that their customers are doing well, and that they will continue to remain healthy for the foreseeable future," Boeddener states. "Our end use industries are pretty secure and are not showing any indication of decline."

Capital equipment producers seem to support this optimistic view. Three manufacturers contacted by PRECISION METAL indicate that sales of roll forming machines for the first half of 1987 have already met or exceeded total shipments for 1986. And some orders are already in for 1988.

Of top management representatives polled by the CRFI, 64% said that their custom roll forming business was good or excellent during the third quarter of 1987, while only 5% said business was poor. 40% responded that the outlook for the future looked brighter, while 52% expect business to remain about the same.

In the same survey, 55% indicated an increase in third quarter 1987 bookings over the previous quarter, and 30% said there was no change. Half reported no change in inquiry flow while 38% said that third quarter inquiries had increased.

Make sure your roll formed shapes count!

An important goal for the custom roll forming industry is to gain the recognition that comes with the assignment of its own SIC code by the Federal government.

In December, the U.S. Department of Commerce Bureau of the Census will be conducting its Census of Manufactures for the year 1987. The Custom Roll Forming Institute (CRFI) urges all companies producing *any* custom roll formed shapes to notify the person responsible for completing the census forms of the correct way to report the data.

Two forms, MC-3408 and MC-3409, will include a specific area in which companies can record their production of roll formed shapes. Companies that receive different forms should include their custom roll formed shape production under an "all other" category.

Companies that produce *any* custom roll formed shapes are urged to contact the CRFI, 522 Westgate Tower, Cleveland, OH 44116, (216)333-8848, if they have any questions concerning how to record their custom roll formed shape production data correctly.

A note about survey data...

Annually, PRECISION METAL surveys a sizable portion of roll forming industry corporate officers to get an idea of what changes have occurred, and what are likely to occur in the industry during the coming year.

Results of our report include data for 12.7% of the 331 custom and captive roll forming plants surveyed in the United States and Canada.

57% of our respondents were custom part producers, 12% were exclusively captive operations, while the remainder performed custom and captive work.

The highlight of our report is the roll forming machine survey, since capital equipment buying decisions can be an excellent measure of current and expected business activity.

COMPONENT MANUFACTURER ROLL FORMING MACHINES

Roll Forming Machines (by number of roll stations)	Number of roll forming machines	Amount 10-20 yrs. old	Amount over 20 yrs. old	To be replaced in 1988	To be rebuilt in 1988	To be added to capacity in 1988
2-4	34	14	16	3	2	2
5-8	80	21	34	3	3	3
9-12	132	29	95	—	18	5
13-15	91	31	42	2	7	4
16-20	40	18	15	—	1	7
21-25	6	4	2	—	1	3

Stamping

Although plagued by continued import troubles, the metal stamping industry is showing some reason for optimism. According to the Precision Metalforming Association (PMA), year-to-date shipments were 4% higher in 1987 than for the same time period in 1986, while bookings showed a 6% increase compared to last year. "The long term backlog trends continue to look fundamentally

strong," says Jon Jenson, PMA president, referring to a 15% increase in backlog over one year ago.

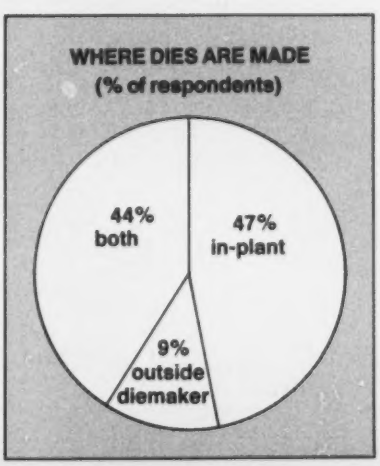
Heavy stampers, primarily automotive, are experiencing level to slightly decreased sales due to continued imports of foreign automobiles and slow sales in domestically produced models. However, continued plant investment in the United States will ease these concerns in the future. According to a vice president of marketing for a large supplier of automotive stampings in the Midwest, "Foreign car manufacturers are going to start using us after they have built plants here. They will find we can deliver a cost effective, quality product, as opposed to shipping parts from overseas and paying the freight."

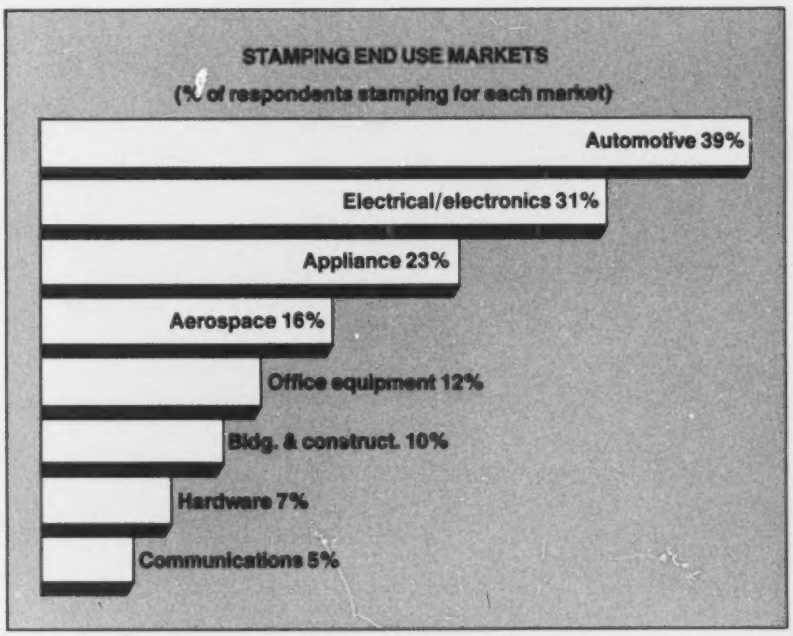
Stampers of smaller components claim they are experiencing better times this year. Ironically, for some of these stampers, this is due in large part to the collapse of their competition. "We are beyond capacity now and in the process of putting in a new press in 1988 to assist," states a stamper of small components. He added that OEM's closing their captive stamping operations has also helped increase his business.

Metalformers of all sizes are reporting continued problems with raw material availability, price and quality. "We are rejecting a lot of steel we finally get these days,"

STAMPING METHODS

Types performed	% of respondents
Progressive die	70
Drawing	36
Compound	13
Multislide	11
Single station	5





COMPONENT MANUFACTURER STAMPING PRESSES

Mechanical Presses (by tons force capacity)	Number of presses	Amount over 20 yrs. old	To be replaced in 1988	To be rebuilt in 1988	To be added to capacity in 1988
1-10	168	107	2	8	5
11-50	768	466	9	40	13
51-100	433	292	13	19	29
101-500	208	133	5	7	18
Over 500	18	13	—	—	1
Hydraulic Presses					
1-10	8	1	—	—	—
11-50	24	8	—	2	2
51-100	12	2	—	—	2
101-500	17	6	—	2	4
Over 500	6	3	—	—	—

A note about survey data...

Annually, PRECISION METAL surveys a sizable portion of stamping industry corporate officers to get an idea of what changes have occurred, and what are likely to occur in the industry during the coming year.

Results of our report include data for 15% of the 1000 custom and captive stamping plants surveyed in the United States and Canada.

60% of our respondents were custom part producers, 28% were exclusively captive operations, while the remainder performed custom and captive work.

The highlight of our report is the stamping press survey, since capital equipment buying decisions can be an excellent measure of current and expected business activity.

explains a custom stamper's vice president of sales. "With the acceptable steel, the price is way out of line, and our customers are refusing to let us pass along the price increase."

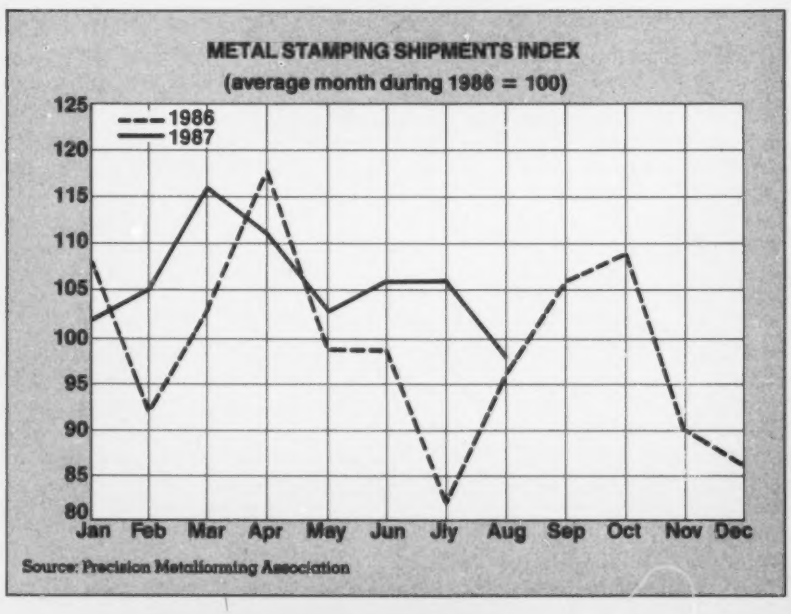
There is a slow evolution taking place within the $21 billion metalforming industry. Stampers are incorporating more types of metal processing equipment in their operations such as press brake work, welding and assembly, while metal fabricators are becoming less labor intensive. The result, as pointed out by the PMA, is that the distinction between stampers and fabricators is becoming less apparent.

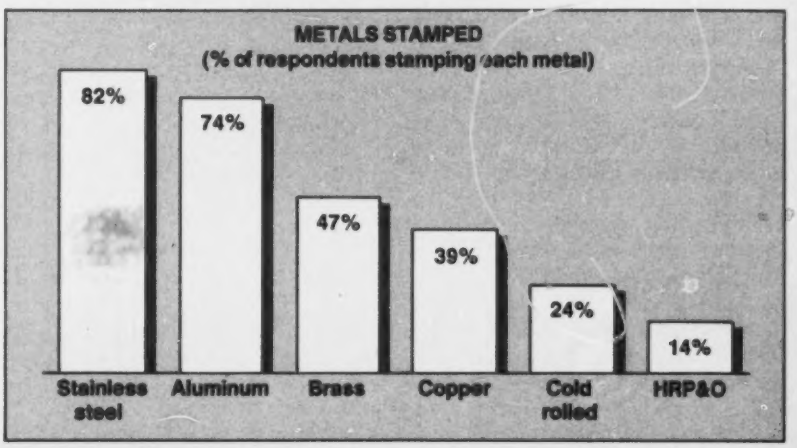
This merging of technologies will have a positive outcome though, as stampers and fabricators alike strive to become more productive and profitable, and therefore, more competitive within the global marketplace.

Cost of metal stampings consumed (millions of $ delivered cost)[1]

End use markets	1977	1982	1988
Electronic components			
Semiconductors & related devices	68.6	94.3	155.4
Electronic connectors	12.2	34.4	49.8
Motor vehicles & equipment			
Motor vehicle & car bodies	6638.0	5065.6	7902.3
Truck & bus bodies	—	25.7	46.6
Vehicle parts & accessories	79.0	228.1	408.4
Office equipment			
Electronic computing equipment	67.4	94.5	133.5
Typewriters & other equipment	37.5	26.3	34.3

[1] Rated at value or projected value of the dollar for each year listed
Sources: U.S. Department of Commerce & Penton Marketing Information center estimates





Raw material outlook

The following section is an assessment of the current conditions and forecasts of several key industrial metals, according to the U.S. Department of Commerce.

Aluminum

Total net shipments for the first seven months of 1987, an estimated 9,723 million lb, were up 3.6% from the 9,387 million lb shipped during the same period in 1986. Domestic shipments of 9,047 million lb were 2% more than the seven month 1986 total of 8,865 million lb.

Aluminum shipments are expected to increase by about 2.2% in 1987, to 16.1 billion lb. Improved demand is expected this year in all major aluminum consuming end-use markets except transportation. Although the amount of aluminum used per car should reach about 150 lb this year, it will be offset by a decrease in automobile production. Reduced defense spending will also lessen demand in the transportation sector, although strong demand in commercial aerospace manufacturing may limit the adverse impact.

Total aluminum shipments are expected to increase at a compound annual rate of about 3% through 1991. The use of aluminum in automobile cylinder heads, body panels, driveshafts, and other parts should increase to about 200 lb per car by 1991. Aluminum will also be more extensively used in the manufacture of railroad cars and dump truck beds. Although the use of aluminum for beverage cans is close to the saturation point, experimentation with different sizes of cans and the packaging of products once thought incompatible with aluminum suggest that new types of aluminum packaging will become commercially successful.

The aluminum industry is also attempting to develop new markets. Aluminum-lithium alloys, which provide greater stiffness and less weight than conventional aluminum alloys, are expected to be used extensively in Boeing's 7J7 commercial airliner, slated for delivery in 1992, and possibly on new versions of existing Boeing planes.

Another innovation is the "sandwich" composite, such as aluminum-steel and aluminum-plastic. Alcoa and 3M are working on an aluminum-aramid laminate for the aerospace industry. All of these materials are strong, lightweight, and can be handled like aluminum sheet in the manufacturing process.

Copper

Domestic copper consumption declined 2% in 1986, to 2.05 million tons. However, copper production rose 3% to 1.6 million tons as previously closed mines and a small amount of new capacity began production during the year. Domestic copper averaged $.67 per lb in 1986, the third year at that price level.

World production overcapacity, low prices and an increase of imported copper have forced the copper industry to restructure and modernize in order to become more competitive with foreign producers. As a result, domestic production capacity declined from 3.1 million tons in 1980 to about 1.8 million tons in 1986. However, there were no permanent closings of U.S. copper refineries last year.

Demand for copper is expected to decline slightly this year, due to slow growth in new construction and a decrease in motor vehicle production. Total copper consumption is projected to fall 1% in 1987 to 2.03 million tons. The growth rate of copper consumption has declined in recent years, due to the development of substitute materials and the implementation of new technologies. Future demand is expected to grow at a rate of 1% a year. Domestic copper consumption is projected to total 2.1 million tons in 1991, roughly equivalent to consumption in 1985.

Fiber optics are expected to make substantial inroads into copper's telecommunications market, where about 250,000 tons of copper are used each year in the production of wire. Approximately 70% of the copper wire produced today is used in long and short haul trunk lines, where fiber optics are expected to become extremely competitive.

Electrical wire manufacturers comprise about 50% of the total yearly demand for copper. Although electrification projects will definitely influence copper demand, implementation seems to be extremely slow. The debt crisis, and the decline in oil prices, have caused many projects to be delayed or cancelled.

Several new uses for copper may have the potential to increase demand. For example, the use of copper in the tubing of fire sprinkler systems and in the production of nuclear waste canisters could conceivably raise overall copper demand by 50,000 tons.

Magnesium

Magnesium shipments during the second quarter of 1987 reached 60,100 metric tons (MT), up 2,900 MT from the first quarter of this year and up 500 MT from the second quarter of 1986. Production of 56,800 MT was up 1,000 MT from the first quarter, but down 1,000 MT from the second quarter of 1986. The combination of lower production and higher shipments in 1987 resulted in a 3,300 MT drop in inventories to 39,200 MT at the end of the second quarter.

Worldwide production in 1986 fell 10,000 tons (4.3%) from 1985, due primarily to the 8.5% decline in production in North America. Production in Latin America and Western Europe experienced a slight increase. Magnesium consumption has also been on the decline in North America, but has

been growing in non-North American markets, most likely due to the strong dollar during the past two years. The weaker dollar should reverse this trend, and symptoms of this change are already evident.

By use, global consumption is increasing in the areas of aluminum alloying, nodular iron, desulfurization and structural products. Although consumption in aluminum alloying has increased rapidly due to growth in the beverage can industry, this market is now considered mature and future growth is expected to be offset by increased recycling. Recycling of beverage cans has reduced global demand for primary magnesium by about 2.5%.

In 1986, consumption of nodular iron increased in Western Europe and decreased in North America, while the use of magnesium for desulfurization increased in both regions. Demand in the nodular iron market has been declining for several reasons, including a switch from cast iron to plastic pipe. But the decline is believed to have reached bottom and slight growth is forecast.

Despite the high interest level in magnesium die castings by the U.S. automotive industry, demand for this application has been on the decline. Reduced production of the Volkswagen "Beetle" and an interest in recycling are the major causes of this decrease. However, this trend is expected to reverse with growth forecast to be 6% a year, primarily due to increased magnesium usage in the U.S. automotive industry.

Nickel

Domestic consumption of primary nickel in 1987 is expected to rise by about 12% to 115,300 tons, due to continued growth in consumer spending for durable goods. However, capital investment in plant and equipment is expected to remain flat. Domestic mine production of nickel could amount to 14,000 tons, or about 10% of U.S. consumption.

World mine production of nickel is expected to increase about 5% to 886,000 tons as many producers attempt to reduce unit costs by maximizing capacity utilization. As a result, effective capacity utilization in 1987 will probably approach 80-85%, up from an estimated 70-75% in 1986.

U.S. primary nickel consumption is forecast to increase about 3.2% annually, reaching 120,000 tons in 1991. However, domestic nickel demand may still fluctuate. Automotive downsizing and the substitution of other materials for nickel have decreased demand, in addition to miniaturization and plastics that have appreciably reduced the amount of nickel used in appliances and other consumer durables. Also, imports of nickel-containing component parts and

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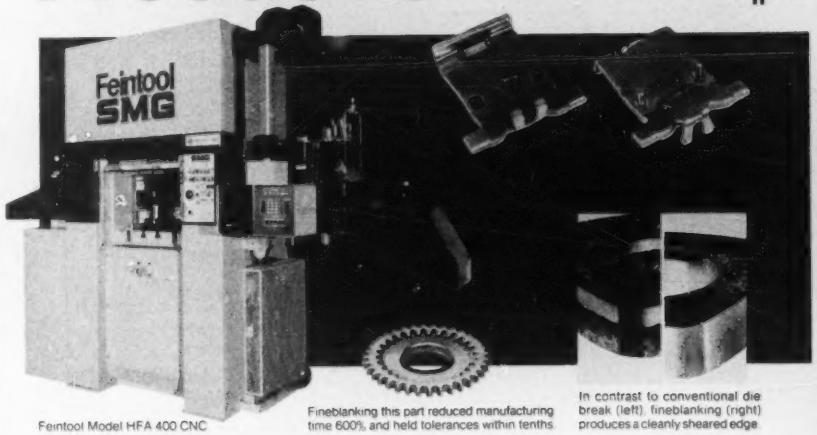

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equipment have lessened U.S. demand.

Still, there are many potential sources of new demand for nickel in pollution abatement and waste treatment equipment, aerospace components, processing equipment for petroleum and higher quality steel, and machinery for electrical power generation.

No expansion of domestic nickel capacity is expected. Worldwide, several additions to nickel capacity have been proposed, but none are likely to occur without a substantial sustained price increase or government underwriting. No supply shortages are anticipated, and while temporary squeezes may boost prices, many producers can readily increase their output by reactivating idle capacity.

Steel

Despite five years of recovery elsewhere in the economy, the long-term slump of the domestic steel industry that began in 1982 shows no signs of ending. In 1986, demand for steel mill products was far below pre-recession levels, as it has been every year since the steel recession began. The problem of steelmaking overcapacity has been exacerbated by the weak demand. The industry has been operating at less than two-thirds of its capacity since 1982, despite capacity cutbacks. The surplus capacity has depressed prices and contributed to the industry's high cost structure.

U.S. raw steel production in the first seven months of 1987 totaled 49,362,000 tons, 4% below the 51,315,000 tons produced in the same 1986 period. During the first half of this year, 60% of raw steel production was processed on continuous casters, compared with 49.5% during the first seven months of 1986.

Steel shipments are likely to decrease about 2.2% in 1987, to 68 million tons. Lower demand from the automotive sector is a major cause of the depressed demand this year, with the Department of Commerce forecasting a 3% decline in sales of domestically produced motor vehicles.

Construction, steel's second largest market, is also expected to decline sharply, with the value of nonresidential construction down at least 5%. In addition to the problems that have hurt the industry in recent years, these sectors will be adversely affected by the tax bill, specifically the removal of the investment tax credit for equipment and less favorable depreciation allowances. Also, the industry is not expected to benefit from further import reduction, because the big adjustment resulting from the restraint program occurred in 1986.

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The substitution trend adversely affecting steel is expected to continue. For example, Ford Motor forecasts that its body exteriors will contain almost 300 lb of plastics by the year 2000, compared to 215 lb in 1987 models. At least one manufacturer, however, has delayed plans to replace the steel bodies of some of its models with plastics, because the falling price of steel has made it more competitive. To combat substitute materials, the steel industry is promoting the use of corrosion resistant, lightweight steels such as electrogalvanized steel, and is improving steel quality.

Titanium

With increases in both mill product shipments and sponge production, the titanium industry has remained strong in 1987. The rise in mill product shipments has been due to increased demand from the civilian aerospace and industrial sectors. Military aerospace demand has increased slightly, after a decline in 1986.

Domestic sponge production should reach 23,000 short tons this year, after falling to 17,400 tons in 1986. The availability of quality scrap has kept scrap consumption strong.

The outlook for titanium mill products through 1991 will continue to depend on production of commercial and military aircraft, which will account for 75-80% of consumption during the next four years. Titanium mill product demand for civilian aircraft is also expected to remain strong, but will not show large yearly increases. The aircraft industry's policy of replacing older planes with lighter, more fuel-efficient models will continue, and many of the newer aircraft will contain a larger proportion of titanium than their predecessors. Military demand will remain strong as the requirements for high-performance airplanes, helicopters, missiles and spacecraft increase.

Prices of the metal are forecast to remain soft through 1991, which will help titanium compete with alternate materials, such as advanced composites. The major challenge for the titanium industry for the rest of the decade will continue to be the expansion of titanium use beyond the aerospace sector.

Tungsten

Any improvement in the overall economy this year should lead to increased production and consumption of tungsten. However, low prices will probably cause production of domestic concentrate to decrease and imports will continue to put pressure on producers of concentrate and APT.

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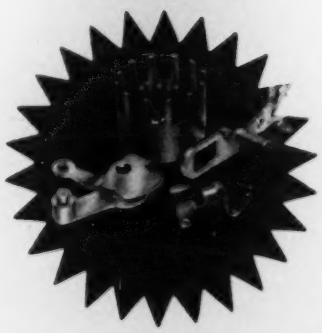

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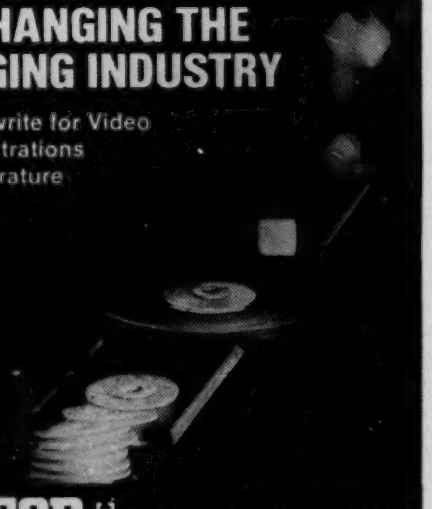

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The outlook for 1988 and beyond is more encouraging, but conditions for producers will not be as favorable as they were during the 1977-81 period. The trend for the growth rate of output of manufactured durables is expected to be higher than last year, but the long-term growth rates of such basic industries as construction, farm and industrial machinery, mining, and oil and gas extraction will be lower than in the late 1970s, tending to moderate growth in tungsten demand.

Zinc

Total zinc consumption is projected to increase 1.5% this year, to 960,000 tons. Zinc used in galvanizing is the only end-use sector expected to improve. This growth will be caused by an increase in demand for electrogalvanized steel sheet in the automotive sector, and will occur despite a projected decline in motor vehicle production. The industry's capacity for production of electrogalvanized steel sheet rose almost 2.5 million tons in 1986.

U.S. production of zinc is forecast to rise 8% in 1987 to 325,000 tons, while imports are expected to remain unchanged at 730,000 tons. Canada and Peru will continue to be the largest sources of imported slab zinc, accounting for 70% of total imports.

Looking ahead, the zinc industry should experience sustained demand growth, with consumption rising about 2% a year to a projected total of 1.04 million tons in 1991. The single largest application for zinc will continue to be galvanizing. The automotive sector's demand for electrogalvanized steel sheet is an important new market, and the expanded availability of electrogalvanized sheet could lead to its use in other products, such as appliances. It has been projected that the market for galvanized sheet will grow 20-25% by the mid-1990s, at the expense of uncoated steel.

The long-term outlook for zinc in other end-use sectors is more restrained. Although the substitution of aluminum and plastic for zinc in automobiles, as well as the conversion to thin-wall die castings, was believed to be complete, the per unit use of zinc castings in motor vehicles declined in 1985, to just under 20 lb per vehicle.

Zinc consumption in both die casting and brass end-use markets will continue to be extremely sensitive to the strength of the dollar and imports of semi-fabricated metal products and finished consumer goods. **PM**

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